

**DETAILED ACTION**

***Response to Amendment***

1. Applicant's amendments filed on 11/03/09 have been entered. Claims 1, 4-15 and 17-30 and 33 are currently under examination on the merits.

***Claim Rejections - 35 USC § 103***

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

4. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(e) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

5. Claims 1, 4-11, 28 and 30 are rejected as being unpatentable over Joret et al. (WO 01/37006), see English language equivalent (U.S. 6,924,037), and in view of Wolfe et al. (U.S. 5,563,734).

Regarding claim 1, Joret et al. discloses a transparent substrate with an antireflective coating of alternating high and low refractive index layers (See Abstract). Joret et al. also discloses using zirconium oxide and/or silicon nitride as the material for the high refractive index layers (C4, L30-40). Joret et al. further discloses that nitrides are advantageous in that they add heat treatable functionality to the laminate (C4, L40-55).

Joret et al. does not disclose that the high refractive index material be a mixed silicon zirconium nitride.

Wolfe et al. discloses a multilayer stack (See abstract) with high and low refractive index layers (C3, L1-20 and C4, L20-50, the first dielectric layer has a refractive index range of from 2.1 to 2.5, while the second dielectric layer has a refractive index range of from 1.98 to 2.08 and lies above the silver functional layer, 12.). A silver layer of metal, 12, is disclosed as reflecting infrared radiation which makes it a solar control functional layer. The second dielectric layer is disclosed as also being made of a composite silicon nitride (C4, L25-45). The high refractive index layer is disclosed as being made up of inter alia zirconium oxide, silicon nitride or a composite film containing zirconium nitride and silicon nitride (SiZrN) (C3, L1-20). Wolfe et al. further discloses that the refractive index of the composite high refractive index films (i.e. SiZrN) can be varied depending on the relative amounts of the different nitrides (C3, L20-35). Since SiZrN, ZrO and Si<sub>3</sub>N<sub>4</sub> are listed as alternatively suitable high refractive index materials

(with  $\text{Si}_3\text{N}_4$  and  $\text{ZrO}$  also being listed in Joret et al.), it would have been obvious to one having ordinary skill in the art to have selected  $\text{SiZrN}$  because the variability of the refractive index thereof would enable a higher degree of freedom and control in selecting the particular refractive index of the high refractive index layer. The refractive index range of the high refractive index layer is disclosed as being between 2.1 and 2.5, which completely overlaps the instant claimed range (C3, L1-20).

Wolfe et al. does not specifically disclose that the ratio of  $\text{Si/Zr}$  in the  $\text{SiZrN}$  layer be between 4.6-5, however, given that Wolfe et al. discloses altering the relative amounts of the nitrides in the composite nitride in order to adjust the refractive index thereof (C3, L20-35), it would have been obvious to one having ordinary skill in the art to adjust, through routine experimentation, the ratio of  $\text{Si/Zr}$  in order to optimize the refractive index of the high refractive index layer. Accordingly, the ratio of  $\text{Si/Zr}$  is considered a result effective variable.

The inventions of both Joret et al. and Wolfe et al. are drawn to the field of coated laminates with high and low refractive index layers and therefore it would have been obvious to one having ordinary skill in the art at the time of the invention to have modified the high refractive index material of Joret et al. by using the  $\text{SiZrN}$  material as taught by Wolfe et al. for the purposes of imparting increased control of the refractive index in the high refractive index layer and it would have also been obvious to have included a silver functional layer as taught by Wolfe et al. for the purposes of imparting solar control functionality to the layer stack.

Regarding claims 4-11, 28 and 30, modified Joret et al. discloses all of the claimed limitations as set forth above. Additionally Joret et al. discloses a laminate that reads on the limitations of instant claims 4-11, 28 and 30.

(With respect to claim 4, see C3, L60-C4, L15, the refractive indexes and the thickness of the preferred embodiments of the invention fall within the claimed ranges of the instant claim. With respect to claim 5, see C5, L5-20, the materials for the second and fourth layers are disclosed as being, inter alia, silicon oxide. With respect to claim 6, see C4, L60-C5, L5, the first and third high refractive index layers are disclosed as being made of several superimposed high refractive index layers, including silicon nitride, which has been shown to be obviously substituted with SiZrN from Wolfe et al as above. See the Table of C13, L5-20, and C13, L20-30. With respect to claims 7-10, the properties of the examples in terms of calorimetry, reflection and TABER test fall within the limitations of instant claims 7-10. With respect to claim 11, see C6, L20-C8, L25, the number of substrates, joining thermoplastic material, and coating on the opposite side meet the limitations of the instant claim. With respect to claims 28 and 30, the glazing laminate of Joret et al. (C5, L35-65) is capable of being subjected to heat treatment (C4, L35-55).)

6. Claims 12, 13 and 20-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wolfe et al. (U.S. 5,563,734).

Regarding claim 12, Wolfe et al. discloses a transparent substrate provided with a thin-film multilayer comprising an alternation of  $n$  functional layers having reflection properties in the infrared and/or in solar radiation and  $n+1$  coatings composed of one or more layers of dielectric material, in such a way that each functional layer is placed between two coatings,

characterized in that at least one of the layers of dielectric material is based on a mixed silicon zirconium nitride.

(See Fig. 1, C3, L1-20, Silicon zirconium nitride (SiZrN) is disclosed as being in the high refractive index layer, 6 and 8, with the second dielectric layer, 16, being the lower refractive index layer (C4, L20-50, n is between 1.98 and 2.08). The refractive index of the high refractive index layer is disclosed as being between 2.1 and 2.5, which substantially overlaps the instant claimed range with the lower endpoint lying within the range. The two dielectric layers are on either side of the silver functional layer, 12, which has infrared reflecting properties and is therefore solar controlling (See Abstract).)

Wolfe et al. does not specifically disclose that the ration of Si/Zr in the SiZrN layer be between 4.6-5, however, given that Wolfe et al. discloses altering the relative amounts of the nitrides in the composite nitride in order to adjust the refractive index thereof (C3, L20-35), it would have been obvious to one having ordinary skill in the art to adjust, through routine experimentation, the ratio of Si/Zr in order to optimize the refractive index of the high refractive index layer. Accordingly, the ration of Si/Zr is considered a result effective variable.

Regarding claims 13, 20-22, Wolfe et al. discloses all of the limitations as set forth above. Additionally Wolfe et al. discloses a transparent substrate which reads on the limitations of instant claims 13, 16, 20-22.

(With respect to claim 13, see Fig. 1, the functional metal layer, inter alia silver, 12, lies between dielectric coating layers 8 and 16. With respect to claims 20-22, see C3, L55-C4, L10, the Ni-Cr nitride layers, 10 and 14, on either side of the functional layers

are disclosed as having a thickness in the range of 8-15 angstroms, or 0.8 to 1.5 nanometers, with the upper endpoint lying within the claimed ranges. See Table 1, C7-C8, the outer or cover layer is silicon nitride.)

7. Claims 14, 15, 17-19 and 25-27 and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wolfe et al. (U.S. 5,563,734) as applied to claim 12 above, and in view of Nadaud et al. (WO 03/010105), see English language equivalent U.S. 2004/0241406).

Regarding claims 14, 17, 18, and 25-29, Wolfe et al. discloses all of the claimed limitations as set forth above. Additionally, Wolfe et al. discloses that Silicone Zirconium nitride is a preferred high refractive index material (with  $n$  between 2.1 and 2.3) (C3, L1-20). Wolfe et al. does not explicitly disclose all of the specific limitations of instant claims 14, 17, 18, and 25-29.

Nadaud et al. discloses a transparent substrate meeting the limitations of instant claims 14, 17, 18, and 25-29.

(With respect to claim 14, see [0037], a stack with two functional layers is disclosed. With respect to claims 17 and 18, the first and last high-index dielectric layer have a thickness in the range of instant claims 17 and 18 (See [0040] and Table 1, 22.5 and 26 nm respectively). The high refractive index layer in between the two functional layers is disclosed as having a thickness falling within the range of instant claim 18 (See [0040] and Table 1, 62 nm). With respect to claims 25-27, see Example 7, [0058], substoichiometric amounts of zinc oxide are disclosed as being placed both above and below the functional layer. With respect to claim 29, see [0037], the two types of stacks

(having both one and two functional layers) read on the limitations of instant claim 29 (replacing the silicon nitride of Nadaud et al. with the Silicon Zirconium Nitride of modified Wolfe et al.).)

In the combination of the two references, it would have been obvious to those having ordinary skill to use the Silicon Zirconium Nitride of modified Wolfe et al. over the Silicon Nitride of Nadaud et al. since the Silicon Zirconium Nitride can have a more finely tuned refractive index based on its ability to be blended at different atomic ratios (Wolfe et al. C3, L5-20).

The inventions of both modified Wolf et al. and Nadaud et al. are drawn to the field of antireflective functional glazings and therefore it would have been obvious to one having ordinary skill in the art at the time of the invention to have further modified the structure of modified Wolf et al. by incorporating the structural arrangement of Nadaud et al., for the purposes of imparting improved heat treatments (Nadaud et al. [0040]).

Regarding claims 15 and 19 Wolfe et al. discloses all of the claimed limitations as set forth above, including dielectric layer thicknesses and refractive indexes above and below each functional layer, but does not disclose the number of functional layers of claims 15 and 19 (i.e. three functional layers).

Nadaud et al. does not explicitly disclose a transparent substrate characterized in that the multilayer comprises three functional layers alternating with four coatings, however it does disclose that the number of functional layers can be  $n$  with  $n+1$  coatings (See Abstract) and furthermore that there could be 2 or more functional layers ([0023]), which implicitly discloses

an embodiment where, at the very least,  $n=3$  (i.e. "2 **or more**"). Furthermore, the thickness of the high refractive index dielectric layers is laid out to be between 55-70 nm in the coating layers between the functional layers and between 20 and 30 nm in the coating layers on the outside of the stack ([0040]). Subsequently it would have been obvious to those having ordinary skill in the art at the time of the invention to create a transparent substrate having the layered structure which is implicitly disclosed to comprise 3 functional layers and 4 coating layers, as in instant claims 15 and 19.

8. Claims 23 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Joret et al. (WO 01/37006), see English language equivalent (U.S. 6,924,037), in view of Wolfe et al. (U.S. 5,563,734), as applied to claim 1 above, and further in view of Kimock et al. (U.S. 5,268,217).

Regarding claims 23 and 24, modified Joret et al. discloses all of the claimed limitations as set forth above. Modified Joret et al. does not disclose that the transparent substrate includes a DLC-based overcoat between 5 and 10 nm thick.

Kimock et al. discloses a transparent substrate with a DLC-based overcoat between 5 and 10 nm thick.

(See C7, L55-65, 50 angstroms, or 5 nm, and (C13, L55-C14, L1), 100 angstrom, or 10 nm, thick diamond like carbon layers are disclosed as being created on the outer surfaces of substrate which have first been magnetron sputtered with, inter alia, silicon nitrides and zirconium nitrides (C5, L25-45) in order to improve abrasion resistance.)

The inventions of both modified Joret et al. and Kimock et al. are drawn to the field of coated laminates with high and low refractive index layers and therefore it would have been obvious to one having ordinary skill in the art at the time of the invention to have modified the transparent substrate of modified Joret et al. by adding the DLC coating as taught by Kimock et al. for the purposes of imparting improved abrasion resistance.

9. Claim 33 is rejected under 35 U.S.C. 103(a) as being unpatentable over Joret et al. (WO 01/37006), see English language equivalent (U.S. 6,924,037), in view of Wolfe et al. (U.S. 5,563,734), as applied to claim 1 above, and further in view of Kida et al. (U.S. 5,354,446).

Regarding claim 33, modified Joret et al. discloses all of the limitations as set forth above. Additionally, Wolfe et al. discloses that Aluminum can be used to dope silicon during sputtering (C6, L10-33).

Modified Joret et al. does not disclose a magnetron sputtering target which would have a difference between the target and the layer.

Kida et al. discloses a plane or tubular, magnetron sputtering target for obtaining at least one layer comprising silicone, zirconium and aluminum,.

(See C4, L40-57, a magnetron sputtering target is disclosed which is created via hot isostatic pressing and cold isostatic pressing (C8, L5-C10, L25), with the target including Si, Zr (Table 2, Example 15, C21-C22) and Al (C6, L12-20). Using the targets of Kida et al. to form the antireflective layered structure of modified Wolfe et al. would inherently have a degree of difference between the ratio of Si/Zr in the target as compared to the ratio in the layer. In the process of optimizing the ratio of Si to Zr in the

layer coating as taught by Wolfe et al. (C3, L20-35), the target used would exhibit the instant claimed ratio difference. The target of Kida et al. is advantageous in that it does not exhibit peeling (C3, L60-C4, L10).)

The inventions of both modified Joret et al. and Kida et al. are drawn to the field of mixed silicon zirconium coatings and therefore it would have been obvious to one having ordinary skill in the art at the time of the invention to have modified the targets of modified Joret et al. by using the hot pressed target of Kida et al. for the purposes of imparting improved peel resistance.

***Response to I.132 Declaration***

10. The declaration under 37 CFR 1.132 filed 09/24/08 is insufficient to overcome the rejection of claims 1, 4-15 and 17-30 and 33 based upon the 103 rejections over Joret et al. in view of Wolfe et al. as set forth in the last Office action because: the facts presented are not germane to the rejection at issue in that they do not provide a showing that Joret teaches away from the composite nitride nor do they provide adequate evidence for a showing of unexpected results (see response to arguments section below).

***Response to Arguments***

11. Applicant's arguments of 11/03/09 are considered moot in light of the new grounds of rejection necessitated by the amendments. Arguments which are still deemed to be relevant are addressed below.

12. Regarding applicant's arguments that the teachings of Wolfe do not provide a motivation to alter the relative amounts of Si and Zr in their SiZrN, the examiner disagrees. Wolfe teaches that two different materials can be combined to form a composite nitride which is

disclosed as being useful because of its particular refractive index. Wolfe discloses, and one having ordinary skill would have independently found it obvious, that combining different materials produces a composite material with a refractive index which can be altered based on the relative amounts of the different materials used in the composite. The refractive index of a single material cannot be altered and because very particular refractive indexes are needed for these type of index matching films, it is very advantageous to be able to fine tune the refractive index of a material by controlling the relative amounts of different materials in the composite. Wolf teaches that either separate targets or a single target alloy can be used to produce the composite nitride and therefore it would have been obvious to use those methods to produce composites having whatever particular refractive index were needed to provide adequate index matching.

13. Regarding applicant's arguments (also present in the declaration) against the intrinsic stress of the second dielectric layer, the examiner first notes that claim 12, unlike claim 1, does not require that the SiZrN be in the outermost layer and therefore could be read upon by Wolfe simply from the underlying layer of SiZrN where the stress issue is not present. Regardless, even the outer high refractive index layer does not teach away from a composite SiZrN material. To the contrary, at C4, L37-45, Wolfe discloses that composites of SiN, (those discussed at C3, L15-40), can be used in the outer dielectric layer. Wolfe only mentions the intrinsic stress as a preferable aspect ("most preferably"), and therefore it would not be enough to teach away from SiZrN even if Wolf discloses it was impossible for the film to exhibit a low intrinsic stress with a composite nitride, which Wolfe does not. In fact, Wolfe's disclosure taken as a whole seems to

indicate that either a SiN or a composite can be used for to provide a low intrinsic stress, otherwise Wolfe would not have mentioned that the composite can be used.

14. Regarding the declaration, for the reasons stated above, Wolfe does not require that the layer have a low intrinsic stress and therefore it cannot be taught away from; however, applicant also appears to be arguing that the intrinsic stress of their SiZrN is unexpectedly low. The examiner notes that there is no evidence presented to show that SiZrN was thought to have a high intrinsic stress (nor is any evidence present to quantify what the expectedly "high" intrinsic stress was). There is also not data provided to show which atomic ratios of Si:Zr produce the unexpectedly low intrinsic stress. No intrinsic stress data of any kind is provided. The declaration's statements that "it was thought that Zr would increase the intrinsic stress" (Page 2) and that "the effect was not as great as would have been expected and indeed rather limited" (Page 4) are insufficient for a finding of unexpected results.

#### ***Conclusion***

15. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event,

however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

16. Any inquiry concerning this communication or earlier communications from the examiner should be directed to MICHAEL B. NELSON whose telephone number is (571) 270-3877. The examiner can normally be reached on Monday through Thursday 6AM-4:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Sample can be reached on (571) 272-1376. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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